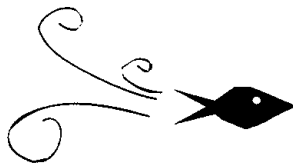


Projects of Regional Scope and Impact

chapter IV



CHAPTER IV. PROJECTS OF REGIONAL SCOPE AND IMPACT

Introduction

Although for convenience sake we sometimes think of coastal embayments as distinct or isolated systems, it is important to remember that currents and tides, nutrient cycles, energy flows, and food webs link the ecological health of each embayment within the Bays area to the larger marine ecosystem. What happens in one part of the Bays ecosystem may affect, for good or ill, other parts of the ecosystem.

A number of large projects are currently being planned or constructed in the Massachusetts Bays region that are expected to have a greater-than-local impact on the water quality, coastal habitat, and living marine resources of the Bays ecosystem. These projects of regional significance (so-called "megaprojects") include:

- Boston Harbor Project: Upgrading Sewage Treatment in the Metro Boston Area
- Central Artery/Tunnel Project
- Boston Harbor Navigation Improvement Project
- Massachusetts Bay Disposal Site

- South Essex Sewerage District Project
- Saugus River Flood Control Project
- Plymouth Sewage Treatment Project

Any comprehensive plan to conserve and manage the Bays' resources would be flawed if it did not examine these megaprojects in some detail. The MBP believes that such expensive and complicated projects should be held to the highest standards of public review. The inclusion of these projects in the CCMP is intended to identify and illuminate issues of environmental concern and to recommend actions that will help ensure the long-term sustainability of the region's marine resources.

Each of the following megaproject discussions is divided into seven sections: Background, Project Description, Expected Benefits, Progress to Date, Work to be Completed, Issues of Concern, and Recommended Actions. With respect to the latter, the Massachusetts Bays Program has attempted to develop and build consensus on those actions which should be taken to ensure that each of the projects proceeds in a manner which maximizes benefits for the people of the region while posing the least risk to the marine ecosystem.

BOSTON HARBOR PROJECT:

UPGRADING SEWAGE TREATMENT IN THE METRO BOSTON AREA

Background

It would be difficult to overstate the significance of Boston Harbor to the city that grew up along its shores. The harbor has served as a channel for commerce and trade, supported fishing and maritime industries, and provided recreational opportunities for millions of people. Unfortunately, many of these values have been impaired by the legacy of using the harbor as a dumping ground for wastewater generated in the Boston metropolitan region.

Boston's earliest settlers discharged their sewage directly into the harbor, but because of their relatively small numbers, this waste did not significantly degrade water quality. As the population of the city and surrounding areas expanded, however, it became evident that the harbor was simply not large enough to dilute the sewage of a large urban population and that some improvements in the sewage disposal system had to be made.

The earliest system improvements were designed to simply push sewage further offshore. For instance, a brick sewer line constructed in the 1870s transported raw sewage under Dorchester Bay to Moon Island, where it was stored temporarily and then released on the outgoing tide. Unfortunately, these early system improvements did not achieve significant water quality benefits, since much of the sewage simply washed back into the harbor on incoming tides.

In 1952, the Metropolitan District Commission (MDC) first began to treat the region's sewage before discharging it into Boston Harbor. A primary treatment plant opened that year on Nut Island in Quincy to treat about one third of the region's wastewater. Sixteen years later, in 1968, a larger plant opened on Deer Island to treat most of the remaining flow. By killing disease-causing bacteria and viruses, these primary treatment plants significantly reduced the human health risk of the effluent discharged into Boston Harbor. They also removed some of the solids from the wastewater flow.

But primary treatment could not remove all of the solids, oxygen-consuming organic matter, or toxic contaminants from the effluent, and as a result, these pollutants continued to enter the harbor. In addition, wastewater sludge was still discharged on outgoing tides. To make matters worse, significant amounts of partially treated and untreated sewage were released into the harbor or its tributaries through combined sewer overflows (CSOs) when the volume of wastewater exceeded the capacity of the treatment plants, during periods of wet weather.

In 1972, only four years after treatment facilities were opened at Deer Island, Congress passed the Clean Water Act, which set national standards for water quality in coastal and inland waters. The MDC, finding itself consistently underfunded by the state legislature, sought an exemption from these federal standards. Meanwhile, water quality continued to deteriorate. By the mid-1980s, Boston Harbor had gained notoriety as one of the nation's most polluted harbors.

The Massachusetts Water Resources Authority (MWRA), an independent authority, was created in 1984 to take responsibility for the water and sewer systems formerly operated by the MDC. In 1985, in response to a series of lawsuits, a federal court found the MDC and its successor, the MWRA, liable for numerous Clean Water Act violations. A detailed compliance schedule for meeting the requirements of the Clean Water Act was established which mandated the construction of a secondary treatment plant to treat the wastewater discharged into Boston Harbor. Unlike primary treatment, which relies solely on physical processes to treat wastewater, secondary treatment uses a combination of physical and biological processes that together are much more efficient at removing most contaminants.

Project Description

The MWRA is moving into compliance with the Clean Water Act by constructing new primary and secondary treatment plants on Deer Island and a new outfall to discharge treated effluent into Massachusetts Bay. Significant interceptor construction and CSO facilities planning also are underway.

The MWRA's efforts are, by any measure, an enormous undertaking. An average of 361 million gallons per day of wastewater passes through the MWRA sewer system--about the combined flow of the Charles, Mystic, and Neponset Rivers. And the Boston Harbor Project's estimated cost of \$3.3 billion makes it one of the biggest public works projects ever undertaken in New England. (Note: the \$3.3 billion includes only the "Boston Harbor Project" proper, not CSO control or collection system improvements.) The Boston Harbor Project and related capital improvements to the sewer system include:

- *Collection and delivery system improvements:* Before wastewater can be treated, it must be collected and delivered to the treatment plants at Deer and Nut Islands. When the MWRA assumed control of Metropolitan Boston's sewer system, it inherited a collection of aging pipes and pumps. Deterioration from age and lack

of maintenance led to numerous backups and overflows. The problem of limited flow capacity was exacerbated by the infiltration of groundwater and inflow from illegally connected sump pumps, improperly connected catch basins, and defective tidegates. Infiltration and inflow (I/I) may constitute as much as 60 percent of average flow in some parts of the system. The MWRA is in the process of rebuilding the collection and pumping system at its most vulnerable points, and is implementing a new flow management strategy to improve overall system efficiency.

- **Combined sewer overflow (CSO) reduction and treatment:** A few communities in the MWRA region have combined sewer systems that carry both wastewater and stormwater. When the carrying capacity of these systems is overwhelmed during periods of wet weather, excess flow may be diverted from approximately 80 CSO outfall pipes directly into Boston Harbor or its tributaries. As part of its recently completed Combined Sewer Overflow/System Master Plan, the MWRA is working to optimize the present system and complete a CSO Facilities Plan to implement an integrated, cost-effective approach to reducing CSO impacts.
- **New headworks:** The treatment plant on Nut Island will eventually be replaced by a headworks to screen wastewater from the southern portion of the collection system. To transport screened sewage from this headworks to the treatment plant at Deer Island, the MWRA is constructing an inter-island tunnel beneath Boston Harbor.
- **New treatment facilities:** Among the most important elements of the MWRA's wastewater efforts are the improvements planned for the treatment plants themselves. The new Deer Island plant already has entirely new primary treatment facilities and will eventually have entirely new secondary treatment facilities. Secondary treatment is expected to significantly improve effluent quality, as shown by the following table which compares the relative effectiveness of primary and secondary treatment for selected pollutants:

Primary Treatment vs. Secondary Treatment

<u>Pollutant</u>	<u>(% Removed)</u>	
	<u>Primary</u>	<u>Secondary</u>
Total Suspended Solids	60	85
Toxic Contaminants	10-46	32-95*
Biochemical Oxygen Demand (BOD)	35	85
Nitrogen	5	10-15

* Range varies based on contaminant type and secondary treatment process used.

Source: Alber, M., J. Hallam, and M.S. Connor, 1993. *The State of Boston Harbor 1992*. MWRA Environmental Quality Department Technical Report No. 93-6, March 1993.

- **Outfall tunnel:** A 9.5-mile outfall tunnel will eventually carry treated effluent to the deeper waters of Massachusetts Bay. At the end of the outfall, effluent will pass through 55 vertical riser pipes into ocean water more than 100 feet deep. Within 200 feet of the diffusing system, the MWRA expects average dilution to be about 150 parts seawater to one part effluent. The model developed by the scientific community predicts that within three to five miles of the diffuser, dilution is expected to be about 400 to 1 (Blumberg et al, 1993).
- **Source reduction:** Through its Toxic Reduction and Control Department (TRAC), the MWRA is working to limit the pollutant loadings that enter the wastewater stream. TRAC issues sewer permits to a variety of commercial and industrial sewer users, monitors their discharges, and enforces discharge regulations. Recognizing that household wastes are another significant source of wastewater contamination, the MWRA has also launched a public outreach effort to educate citizens about the proper use and disposal of hazardous household products.

Expected Benefits

The Boston Harbor Project and the other wastewater system improvements are expected to make the harbor healthier than it has been in more than a century. Computer models predict that with the new outfall, effluent will be more diluted throughout Massachusetts and Cape Cod Bays, especially in near-shore waters (Blumberg et al, 1993). The EPA's Supplemental Environmental Impact Statement (SEIS) for the outfall predicts that once secondary treatment exists, Massachusetts Bay will meet most water quality goals set by the state, but not all, due to ambient conditions (e.g., PCBs). CSO and other collection system improvements are also expected to result in significant water quality improvements to Boston Harbor and its tributaries.

Progress to Date

Since starting the Boston Harbor Project, the MWRA has met several major construction deadlines. By the fall of 1995, nearly all of the design and three quarters of the construction had been completed at a cost \$700 million below the FY 1988 estimate. Progress to date on this and other wastewater efforts includes:

- *Improvements to the collection and delivery system:* Much of the collection system has already been inspected and repaired. In 1990, the MWRA completed upgrades of its existing headworks facilities and the old Deer Island Power and Pump station. Since then, significant repair and replacement of three other pump stations have also taken place. One indication of overall system improvement is the decrease in "choking time" at the Deer Island headworks which dropped from more than 5,000 hours in FY 1987 to less than 1,000 hours per year in FY 1991 through FY 1994. New pumps at the new Deer Island Treatment Plant are expected to sustain and enhance the improvements made by these interim upgrades.
- *Combined sewer overflows:* Working with the Boston Water and Sewer Commission and the other combined sewer communities, the MWRA has successfully increased the amount of combined flow that reaches its treatment plants. Dry weather CSOs have been non-existent for the past several years, and wet weather CSOs have been significantly reduced since the mid-1980s. The MWRA has also constructed or upgraded six major CSO treatment facilities which provide screening and chemical disinfection to much of the excess flow. Approximately 60% of the overflow is now screened and disinfected before being discharged.

In 1994, the MWRA completed a conceptual long-term CSO plan that uses a watershed approach to evaluate the relative contribution of CSOs compared with other sources. Implementation of the plan, which is currently

in the State environmental review process, will: 1) eliminate CSO discharges to Dorchester Bay, the Neponset River, and Constitution Beach, 2) reduce untreated overflows in each of 10 other receiving waters to an average of one to four times per year (versus the current discharge of up to 80 times per year in some areas), and 3) upgrade existing CSO facilities at Cottage Farm, Prison Point, and East Somerville, as well as construct additional CSO treatment facilities to increase control of bacteria and floating pollution to Boston Harbor and its tributaries.

- *Interim improvements to primary facilities:* In addition to installing new disinfection systems which are more reliable and which use an agent which is safer to store and handle, the MWRA has installed new scum removal systems at the Deer Island and Nut Island treatment plants to remove grease and floatable trash from the top of sedimentation tanks. These scum removal systems are responsible for a noticeable improvement to the aesthetics of Boston Harbor. The new Deer Island Treatment Plant includes scum removal facilities that will maintain the level of performance reached by these interim improvements.
- *Sludge processing facilities:* Perhaps the single greatest improvement to date involves the solids which settle out in sedimentation tanks. Previously, this "sludge" was dumped back into the harbor after digestion--some 40 tons of sludge were discharged on the outgoing tide every day. In December 1991, the MWRA opened its new sludge-to-fertilizer plant at the former Fore River Shipyard. Sludge which used to be discharged to the harbor is now barged to the pelletizing plant, where it is converted into high-grade fertilizer. Since sludge dumping was ended, concentrations of sewage-related bacteria in the harbor have dropped dramatically, especially in the vicinity of the old sludge outfall.
- *Nut Island headworks and inter-island tunnel:* Construction of the new Nut Island headworks began in the summer of 1992 and is scheduled for completion in 1996. Construction of the inter-island tunnel began in December 1992. Although extremely poor rock conditions and other problems have slowed progress, in November 1995 the contractor completed excavation and began preparations for lining the tunnel.
- *New primary and secondary treatment plants:* The MWRA has made substantial progress toward the completion of the new primary and secondary treatment plants. In January 1995, the MWRA successfully introduced wastewater into the first half of the new primary plant. The second half of the new primary plant was placed in operation later in the year.

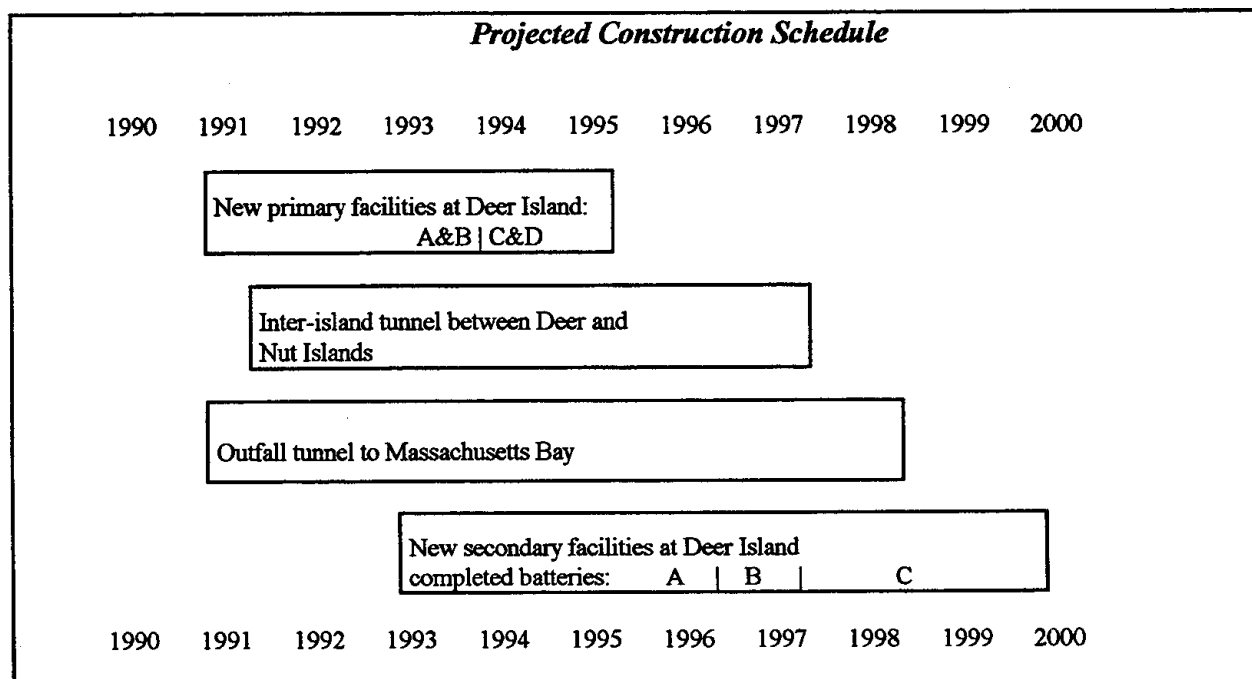
Construction is also underway on the first two batteries of secondary treatment. The first major contract for construction of the secondary treatment plants began in November 1992 and the second in August 1993.

In August 1991, the MWRA began constructing eight new sludge digesters on Deer Island. Four were placed into operation in the summer of 1995. These egg-shaped storage tanks process sludge from the new treatment facilities, cutting its volume in half and reducing odor - and disease-causing bacteria. Construction of the remaining four digesters was completed in November 1995.

- **Outfall tunnel:** Excavation began in June 1992. That same summer, crews installed 55 vertical riser pipes that will eventually connect to the last section of the outfall tunnel. Although progress has been stalled several times due to mechanical difficulties and tunneling conditions, more than 8 miles of tunnel had been excavated by November 1995. Construction of the tunnel is currently several years behind the MWRA's original schedule.
- **Toxic reduction and control:** Over the past several years, the MWRA has continually refined its toxic reduction and control program. Since 1984, there has been a 75% decrease in the total amount of metals in the MWRA effluent.

Work to be Completed

- **Boston Harbor Project:** Despite the progress made to date, completing the Boston Harbor Project continues to present significant challenges. The new treatment facilities at the Deer Island plant are scheduled to go on line in phases, beginning with the introduction of wastewater into the first half of the new primary treatment plant in January 1995. If no major changes are made to the project, secondary treatment facilities are scheduled to be completed by December 1999. The construction timetable is summarized in the chart below.
- **Wastewater Management:** Other continuing challenges include maintaining the new system assets, extending the useful life of older facilities as much as possible, and completing the construction of large and aggressive CSO and sewage interceptor improvement projects.



Issues of Concern

The Boston Harbor Project raises a number of issues with which the Massachusetts Bays Program is concerned. These include:

- *Outfall tunnel:* Perhaps the most controversial component of the Boston Harbor Project is the 9.5-mile outfall tunnel which will disperse treated wastewater into Massachusetts Bay. The U.S. Environmental Protection Agency (EPA) approved the location of the outfall after federal and state agencies made detailed assessments of the project's potential environmental impact as required by the National Environmental Policy Act and the Massachusetts Environmental Policy Act.

The MWRA's decision to proceed with the outfall was based on the best available scientific data. However, there has been concern that relocation of nutrient loading to the vicinity of the outfall terminus may trigger eutrophication or algal blooms in Massachusetts Bay. Aside from being aesthetically unpleasant, algal blooms could potentially cause severe hypoxia (oxygen depletion from organic decay) and thereby adversely impact the marine ecosystem of Massachusetts Bay. The potential impacts could be heightened if effluent was discharged through the outfall before full secondary treatment had come on line. A separate concern related to nutrient loading is a group of algae known as dinoflagellates, some species of which produce the toxins responsible for paralytic shellfish poisoning (PSP).

Moreover, there has been concern that the outfall will negatively impact the resources of Stellwagen Basin and Stellwagen Bank, a sandy underwater plateau located about 16.5 miles from the outfall terminus. The nutrient-rich waters of the Bank, which was recently designated as a National Marine Sanctuary, are a feeding ground for several species of marine mammals, including the endangered humpback, right, fin, and sei whales. Because the deep water in Stellwagen Basin does not circulate freely, it is especially sensitive to the potential for depressed dissolved oxygen. Reduced dissolved oxygen may adversely impact the prey of marine mammals, which in turn could negatively affect the marine mammals present.

The MWRA has acknowledged that "processes associated with eutrophication and species changes are complex and, to a degree, unpredictable," and EPA's Supplemental EIS predicts a modest increase in algal production near the outfall. But it appears that most of the pollutants released from the existing outfalls at the entrances to Boston Harbor already make their way to Massachusetts Bay on outgoing tides. The Authority maintains that no Baywide eutrophication or hypoxia will occur, and that the new outfall will have minimal or

no impact on the resources of Stellwagen Basin or Stellwagen Bank. Federal agencies, including EPA and the National Marine Fisheries Service (NMFS), have reached the same conclusion, stating the outfall pipe "is not likely to jeopardize the continued existence of any endangered or threatened species." However, they recognize the uncertainty surrounding the ecosystem's response to the cumulative impacts of this discharge and all other pollutant sources to the Bays.

In response to concerns about the effects of the new outfall on Massachusetts and Cape Cod Bays, an Outfall Monitoring Task Force (OMTF) was established to report to the Secretary of Environmental Affairs on the outfall's environmental impact. The OMTF consists of academic scientists, officials from state and federal agencies, and representatives from environmental interest groups. The MWRA began monitoring in February 1992 with several baseline studies to determine conditions in the Bay before the new outfall begins discharging effluent. Sampling has been concentrated in the area immediately surrounding the outfall, but extends into remote areas of the Bays as well. The OMTF will examine and interpret monitoring data and suggest remedial action should it determine that the outfall is causing an adverse impact on Massachusetts Bay. In addition, the MWRA, EPA, and the NMFS recently entered into an Agreement to conduct various activities to monitor and study effects of the outfall discharge on the marine environment. The MWRA also released for comment a Draft Contingency Plan (March 1995), which describes ongoing action to ensure protection of the ecosystem and triggers for conducting additional studies and taking future action as needed.

- *Rate increases:* The benefits of the Boston Harbor Project have not come cheaply. Most of the project is being financed with 30-year revenue bonds. Although the federal government has committed \$632 million dollars to the project, and the Commonwealth recently established a Rate Relief Fund to help offset debt service costs, MWRA ratepayers will likely shoulder almost 65 percent of the project cost. Annual water and sewer bills, which averaged \$410 per household in 1991, are expected to rise throughout and beyond the remainder of the decade. Every homeowner, business owner, or renter who flushes a toilet in the 43 MWRA sewer communities will feel the burden, especially those on low or fixed incomes. Although the MWRA has kept average rate increases lower than first expected, public support for additional water quality improvements in Boston Harbor and elsewhere may depend on keeping project costs to a minimum and finding additional state and federal revenues to finance the project. The MWRA is currently working with a broad coalition seeking additional federal and state revenue for the Boston Harbor Project.

- *Project revisions:* Any project as extensive as the Boston Harbor Project must be subject to revision as better data become available. The most significant revision recently considered concerns the capacity of the secondary treatment facilities. A study completed by the MWRA indicated that due to revised estimates of flows and loads based on actual data, the size of the planned secondary treatment facilities could be reduced while still meeting all Clean Water Act requirements. Based on this information, the Federal Court recently approved the elimination of Battery D of secondary treatment.

Recommended Actions

The Massachusetts Bays Program has attempted to identify areas of environmental concern and to build consensus on those actions which should be taken to ensure that the project proceeds in a manner that both maximizes benefits for the people of the region and poses the least risk to the marine ecosystem. The following recommendations have been developed by the staff of the Massachusetts Bays Program, with input from officials from the implementing agencies and interested members of the public.

The Massachusetts Water Resources Authority (MWRA) should:

- plan its operating budget to ensure sufficient funds are available for operation and maintenance of the new treatment facilities. (This budget parameter is a requirement for the receipt of federal funding.);
- continue aggressive enforcement of industrial permits;
- continue efforts to reduce household hazardous waste and to educate the public about proper use of the sewer system;
- eliminate CSOs where deemed appropriate by a public review process;
- continue maintaining the sewer system;
- monitor the health of the ecological community by assessing species abundance *and* diversity of the benthos in Stellwagen Basin, in Cape Cod Bay, and near the outfall; and
- implement contingency planning, with public input, based on meaningful and verifiable triggers.

Communities and citizen organizations have taken an active role in reviewing and commenting on the March 1995 Draft Contingency Plan. The Coastal Advocacy Network and others have recommended that, should unforeseen circumstances seriously threaten the health

of the Bays, the contingency planning process should give consideration to all contingency options, including advanced levels of treatment (e.g., effluent filtration, organic polymer addition, etc.) and inshore diversion of effluent. Several communities have expressed the concern that contingency planning should protect the health of Boston Harbor, as it continues to recover from the effects of past effluent discharges. The Massachusetts Bays Program recommends that the MWRA should:

- consider *all* contingency planning options, and, consistent with the goals of this CCMP, the MWRA should strive to protect *all* of our shared coastal resources, from the North Shore to Boston Harbor to Cape Cod Bay; and
- continue to make all monitoring data available to interested parties in a mutually-agreed upon and timely fashion.

The 43 MWRA customer communities should:

- minimize infiltration and inflow;
- implement strong stormwater management measures aimed at achieving the water quality standards in Boston Harbor and its tributaries; and
- maintain their portions of the sewer system.

The Outfall Monitoring Task Force should:

- Adopt meaningful change values for several environmental indicators, including, but not necessarily limited to:
 1. percent change in liver lesions of winter flounder;
 2. exceedences of water quality standards;
 3. exceedences of FDA limits for seafood safety; and
 4. changes in dissolved oxygen for Stellwagen Basin.
- Recommend meaningful changes for:
 1. biological productivity; and
 2. structure of the benthic community, particularly as it relates to contaminant levels in marine sediments.
- Ensure that MWRA monitoring efforts are coordinated with the state's planned monitoring program and the nationwide marine monitoring programs.

The U.S. Environmental Protection Agency (EPA) should:

- in collaboration with DEP, ensure MWRA compliance

with its discharge permit when the permit is finalized and becomes effective; and

- continue to collaborate with MWRA and NMFS on the Memorandum of Understanding (MOU) to implement the conservation recommendations in the NOAA Biological Opinion.

The National Marine Fisheries Service (NMFS) should:

- immediately implement the Recovery Plans for the North Atlantic Right Whale and Humpback Whale.

The National Oceanic and Atmospheric Administration (NOAA) should:

- continue to upgrade modeling techniques and pursue acoustical methods for the monitoring of outfall-generated plumes.

The Department of Environmental Protection (DEP) should:

- in collaboration with EPA, ensure MWRA compliance with its discharge permit when the permit is finalized and becomes effective.

CENTRAL ARTERY / TUNNEL (CA/T) PROJECT

Introduction

Almost everyone who lives or works in Boston is familiar with the elevated highway slicing through the heart of the city. This section of Interstate 93--better known as the Central Artery--serves approximately 190,000 vehicles every day. Few people like to drive on this road, and with good reason--the Artery's safe design capacity is only 75,000 vehicles per day. Traffic jams are the norm and the accident rate is about twice the national average for urban interstates.

The Central Artery/Tunnel (CA/T) Project is designed to increase the capacity and safety of the highway system, improve access to Logan Airport and the South Boston seaport, and reduce congestion on roads in downtown Boston. By most accounts, the project is much needed and long overdue. The Massachusetts Highway Department first projected the need for a third harbor tunnel in 1957, and a 1974 study confirmed the technical feasibility of depressing the artery. The ambitious project now underway will finally achieve those visions. In doing so, it will transform Boston, not only by altering traffic patterns in and around the city, but by creating about 20 acres of new open space in the Central Artery area when the existing artery is dismantled.

Project Description

The \$7.9 billion CA/T project consists of four major components:

- a widened, mostly underground I-93 (Central Artery) from Charlestown to just south of the Massachusetts Avenue interchange. The new artery will have 8 traffic lanes plus intermittent auxiliary lanes;
- an I-90 (Massachusetts Turnpike) extension via a Seaport Access Highway and Harbor Tunnel to Logan Airport in East Boston, with a connection to Route 1A. The new harbor tunnel extends from the Subaru terminal in South Boston to Bird Island Flats in East Boston (The new harbor tunnel was opened December 15, 1995 and dedicated as the "Ted Williams Tunnel".);
- an extended frontage road system parallel to I-93, both northbound and southbound, from Causeway Street to just past Southampton Street; and
- a South Boston Bypass Road to connect I-93 to the Seaport Access Highway and the Commonwealth Flats area of South Boston. (The South Boston Bypass Road opened December 15, 1995.).

Roughly half the project will be constructed within the existing I-93/Central Artery right of way, and the rest on a new right-of-way through industrial areas of South Boston and Logan Airport.

Expected Benefits

The CA/T Project will expand the capacity and improve the geometry of the existing highway system. When it is completed, the new Artery will be able to accommodate 247,000 vehicles per day. The project will have other benefits aside from improving traffic flow through Boston, however. Despite a small, temporary decline in downtown sales while the artery is under construction, the project is expected to generate economic benefits for Boston and the region. Reorganizing the many underground utilities will greatly benefit future maintenance.

The project may also have a number of environmental benefits, including:

- improvements in air quality resulting from fewer traffic snarls;
- increased parkland and open space in downtown Boston, East Boston, along the Charles River, and on Spectacle Island;
- a cap to prevent leaching from the existing landfill on Spectacle Island; and
- restoration of 14 acres of coastal wetland at Rumney Marsh.

Progress to Date

As of February 1996, the CA/T Project had awarded approximately \$3.3 billion in design and construction contracts. Progress on the major components of the project is as follows:

- *Central Artery:* early in 1993, project crews began relocating the jumble of utility lines within the area of the new underground artery. Site preparation is expected to be finished in 1996.
- *Ted Williams Tunnel:* constructing the 540-foot-wide tunnel trench required the removal of over 200,000 cubic yards of rock from beneath the harbor floor, and clamshell dredging to remove more than one million cubic yards of marine sediment and clay. The tunnel

itself is made up of a series of steel and concrete tubes which were constructed off-site, towed into Boston Harbor by barge, and lowered into the trench. Approximately nine months after the first section of tube was placed in February 1993, all 12 tube sections had been installed and connected. The tunnel was completed and opened for interim use by authorized vehicles in December 1995.

- *Surface roads:* The South Boston Haul Road, which opened to commercial traffic in September 1993, represents the first mile of completed roadway on the CA/T Project. The South Boston Bypass Road, which connects the Haul Road to the Southeast Expressway, was opened in December 1995.
- *Spectacle Island:* Material from the CA/T Project will be used to cover an existing landfill on Spectacle Island. More than two million of the 2.7 million cubic yards of material earmarked for the island have already been delivered.

Work to be Completed

A carefully phased and coordinated construction program has been developed to maintain surface traffic through the city and to minimize disruptions to Boston residents and businesses. Construction on the Project's major components is expected to proceed as follows:

- *Central Artery:* Construction of the new under-ground expressway along Atlantic Avenue began in September 1995. By 2003, the tunnels are expected to be operational both northbound and southbound. The final components of I-93, including removal of the old elevated Artery and construction of the Charles River Crossing, are expected to be operational by 2004.
- *Spectacle Island:* After the existing landfill is capped, Spectacle Island will be regraded and revegetated for use as a park as envisioned in the Boston Harbor Islands State Park Master Plan.
- *Permitting process:* Permits from agencies which regulate activity in or near the water have been of special concern to the Massachusetts Bays Program. To date, the CA/T Project has successfully handled a very large and complex permitting process without encountering significant obstacles.

Issues of Concern

The Massachusetts Bays Program is concerned with the project's potential impact on water quality in Boston Harbor and its main tributaries, as well as its potential impact on fragile coastal areas, including the islands of Boston Harbor.

- *Aquatic habitat:* Existing environmental regulations strongly discourage placing fill in coastal waters. Although early design modifications reduced intrusion into coastal waters, current design specifications still require fill to cover several acres of benthic habitat. Eight acres of aquatic habitat around Spectacle Island have already been filled to facilitate the landfill closure plan. Another five acres will be filled in Fort Point Channel. A November 1995 project design change will reduce the amount of proposed fill in the Millers River. Compensatory mitigation for aquatic habitat losses is currently in the planning as well as preliminary construction phases.
 - *Disposal of excavated and dredged materials:* After more than 5 years of construction, the CA/T Project has excavated roughly 25 percent of the approximately 14 million cubic yards of total material it is expected to dig up or dredge. Suitable material will be used for Project backfill, as needed. In addition, the CA/T Project has coordinated with DEP to develop a program for beneficially reusing clay at publicly-owned landfills. This program seeks to ensure environmentally sound management of the clay and till. One million cubic yards of dredged sediment have already been placed at the Massachusetts Bay Disposal Site (MBDS) and at Governor's Island. Additional dredged material from Fort Point Channel and the Charles River Crossing will be disposed of at the MBDS and Spectacle Island in the future.
- City conservation officials have expressed concern over the adequacy of erosion control measures at Spectacle Island, and have reported incidents of erosion of fill material at Spectacle Island during severe weather conditions. In order to prevent further erosion of fill, CA/T Project officials have stated that effective best management practices have been instituted around the perimeter of Spectacle Island.
- *Stormwater system design:* The amount of stormwater discharged in the project area will not change substantially, but the project is expected to change drainage patterns and the rate of storm flow at several locations.

Although all stormwater systems have not yet been designed, runoff from construction areas will be directed to existing or new storm sewers, all of which must meet current state regulations for stormwater discharge. In areas where new storm sewers are constructed, combined sewer overflows (CSOs) are expected to decrease.

- **Sedimentation:** In 1991, the CA/T Project obtained the first-in-the-nation NPDES permit for construction site dewatering and stormwater runoff. Consistent with the permit requirements, contract specifications include strict performance standards to be met by contractors via the use of best management practices.
- **Public access to waterfront areas:** Most phases of the construction project have been planned to ensure that public access to the waterfront is not seriously impeded. The banks of the lower Charles and Millers Rivers will be disturbed by construction activities during later stages of the project. These bank areas currently provide only limited access west of the existing I-93 corridor as they are not yet developed as public open space. When construction is completed, the current design is expected to expand parkland in the river basin, allowing pedestrian and bicycle connections from the esplanade to the harbor.
- **Aesthetic concerns:** The CA/T Project will include some temporary facilities near the waterfront, including a casting basin at the edge of Fort Point Channel, and a large number of temporary bridges, ramps, barricades, and fences throughout the project area. These temporary aesthetic concerns are minimized since the project area is an already highly developed industrial zone.

Permanent features of the project, especially the Charles River Crossing, will reduce impacts on aquatic resources and navigation, and will reduce visual impacts in comparison to earlier alternative designs officially considered in the environmental process. This design was approved by the Secretary of Environmental Affairs in March 1994 and by the Federal Highway Administration in June 1994. The crossing will be built on the banks of the Charles River, near the point where it flows into Boston Harbor. The crossing will include a mainline (I-93) long-span cablestayed bridge with 10 travel lanes carrying traffic between downtown Boston and Routes 1 and I-93 north of the river. Connections to and from Leverett Circle/Storrow Drive will be on a second 4-lane bridge similar in profile to the mainline bridge, and by land-based tunnels south of the river passing below the North Station railroad tracks.

Recommended Actions

The MBP has not developed recommendations specific to the Central Artery/Tunnel Project at this time. However, the MBP will continue to track the nature and progress of the project, and will issue future recommendations as determined appropriate.

BOSTON HARBOR NAVIGATION IMPROVEMENT PROJECT

Background

In 1634, only four years after settlers from the Massachusetts Bay Company first arrived in Boston, Englishman William Wood described Boston Harbor as "fittest for such as can Trade into England, for such commodities as the Country wants, being the chief place for shipping and Merchandise." Encouraged by Wood's description, trading ships soon began to frequent the harbor, and since that time, Boston has become one of the busiest commercial ports in the United States.

Of course, Boston Harbor was more than deep enough to accommodate the sailing ships with which William Wood was familiar. The large-draft ships and tankers which run through the harbor today, however, need deep access channels to navigate safely. Shipping companies have long known that large vessels minimize the cost of transporting bulk cargo. It is not surprising, then, that the average vessel in the worldwide commercial shipping fleet has steadily become larger in length, beam, and draft. In the last 160 years, Boston Harbor has been dredged repeatedly to accommodate the growing commercial fleet. Occasional improvement dredgings to increase channel depths have been supplemented with more frequent maintenance dredgings, the last of which occurred in 1983.

The container ships and tankers which are the mainstay of today's international shipping industry need 40-foot access channels to navigate safely and efficiently. While Boston Harbor's principal entrance and main access channels are 40 feet deep, its three major tributaries, along which most port terminals are located, are only 35 feet deep. These channels and many of their berths are currently too shallow to accommodate commercial traffic except during high tides, resulting in tidal delays and limits on vessel size and loading.

Even slight delays can substantially increase the operating costs of a shipping company and jeopardize its long-term profitability. This is especially true in the northern Atlantic, where commercial shipping is a highly competitive enterprise. In order to avoid delays, shipping companies sometimes engage in "lightering," or transferring their cargo to a barge. This may raise a ship enough to navigate a shallow channel or dock at a shallow berth. Although lightering is time-consuming and expensive, it is of necessity an increasingly common practice in Boston Harbor.

Increased operating costs associated with tidal delays and lightering have already discouraged some shipping lines from calling on the Port of Boston, and may prevent the port from attracting new business in the future. Since the 1960s,

Congress has recognized that Boston Harbor needs deeper channels to maintain its position as a prominent international port. A study completed in 1988 established the feasibility of the proposed Navigation Improvement Project, which was authorized in the Federal Water Resources Development Act of 1990.

Project Description

The Boston Harbor Navigation Improvement Project would deepen several major tributaries of Boston Harbor:

- *Reserved Channel:* most of the existing 35-foot channel would be deepened to 40 feet, including a portion of the main ship channel to provide a deep-water turning area.
- *Mystic River:* a major portion of the existing 35-foot channel would be deepened to 40 feet, except for areas along the south side and at the upstream limit where 40-foot depths are not required.
- *Chelsea River:* the existing 35-foot channel would be deepened to 38 feet after the relocation and alteration of utility crossings beneath the channel.
- *Inner Confluence Area:* the 35-foot confluence of the Mystic and Chelsea Rivers along the East Boston waterfront would be deepened to provide a safe 40-foot approach to both the Mystic River and Chelsea River.
- *Berth dredging:* berths that will economically benefit from channel dredging would be deepened at non-federal expense.

Project cost and cost sharing are both dependent on the two stages required to complete the project: dredging of channel maintenance material and improvement dredging.

Maintenance Dredging: The existing tributary channels to be deepened by the project have been maintained to the authorized 35-foot depth. The cost of dredging maintenance material during project construction will be funded as maintenance dredging at 100% federal cost. Maintenance material is primarily silt (about 896,800 cubic yards [cy]) which has accumulated since the channels were last deepened, and is contaminated with organic compounds, heavy metals, and other toxic compounds. Maintenance material must be removed prior to the improvement dredging. It is estimated that disposal of maintenance material in-channel (Mystic River, Chelsea River, and Inner Confluence) will cost \$32 million.

Improvement Dredging: The cost of the Navigation Improvement Project (deepen from -35 ft mean low water [MLW] to project depth) will be shared. The federal share of the project is \$18,695,000, which includes 65% of the cost of channel deepening and the U.S. Coast Guard cost for navigation aids. The non-federal share is \$11,820,000, which includes 35% of the cost of channel deepening and 100% of the cost to deepen berth areas and relocate or protect utilities. The total cost for the improvement project is \$30,515,000. Materials to be removed consist of silts in the project berths (54,500 cy), undisturbed parent material from the channels (1,550,700 cy), undisturbed parent material from the project berths (71,600 cy), and rock from the channels (88,100 cy).

Expected Benefits

Ships carry approximately 95 percent of America's foreign commerce. International trade is the fastest growing segment of the American economy, and is expected to expand even more rapidly as a result of recent trade agreements.

As one of the country's oldest and most experienced ports, Boston is an important gateway for international commerce. More than 25 million tons of cargo, worth some seven billion dollars, pass through the Port of Boston each year. More than 6,000 people are directly employed by the cargo industry in Boston, and another 3,000 have jobs which indirectly support this activity. In 1992, shipments through Boston generated nearly \$1.86 billion in economic benefits for the region.

By reducing the cost of transporting bulk commodities through the Port of Boston and reducing tidal delays for larger vessels, the Navigation Improvement Project will increase the efficiency and competitiveness of Boston Harbor and bring economic benefits to the entire region. By allowing the passage of larger, more efficient vessels over a longer period of the tidal cycle, and by reducing barge traffic from nearby ports, the project should alleviate congestion in the harbor. The project also should reduce the risk of accidents and hazardous materials spills.

Progress to Date

Preconstruction engineering and project design began in September 1990. Ship simulation model studies were used to determine optimum channel dimensions and locations, and subsurface material surveys were completed by November 1992. Massport and the Army Corps of Engineers (ACOE) filed a Final EIR/EIS in June 1995. A 60-day comment period followed, and a Massachusetts Environmental Policy Act (MEPA) Certificate was issued in September 1995.

Work to be Completed

Massport and the ACOE are initiating the permit application process. Construction, which would take approximately 18 months to complete, could begin as early as 1997.

It is expected that the ACOE will issue one dredging contract for both the channels and the berths. This will likely require special arrangements between the ACOE and Massport, since berth dredging is a non-federal responsibility. Massport is the project's non-federal sponsor. Massport's responsibilities are generally outlined in the Water Resources Development Act of 1986 and will be more particularly described in the Project Cooperation Agreement (PCA). The ACOE and Massport will work together to assure that all permit requirements are met, whether it be through the ACOE contract or separately.

Altogether, the project will dispose of 1.1 million cubic yards of contaminated sediments in cells to be constructed below the federal navigation channels in the Mystic River, Chelsea River, and Inner Confluence area. The silt will be capped with three feet of clean material and armored with rock in areas of significant propeller wash. In the course of conducting characterization studies on the marine sediment in the proposed project area, the ACOE determined that the 1.1 million cubic yards of surface silt in the project area is not suitable for unconfined ocean disposal. The remaining material which meets federal criteria will be disposed of at the Massachusetts Bays Disposal Site (MBDS).

Issues of Concern

- *Disposal of contaminated sediments:* surface sediments dredged from the floor of Boston Harbor are not suitable for unconfined or confined ocean disposal. The ACOE and Massport have conducted a detailed analysis of alternative disposal sites. Using criteria based on technical feasibility, environmental impact, and cost, the project team initially selected 351 possible disposal sites. More rigorous screening criteria were used to narrow the number of sites to 21, then to 6 "preferred practicable" sites, and finally to a combination of in-channel locations.

The preferred disposal site identified in the EIR/EIS for the silty maintenance material is in-channel disposal. The silty material would be buried deeper than the authorized depth in the Mystic River, Chelsea River, and Inner Confluence, and then capped with coarse grained material. The clean parent material (Boston blue clay, and rock and gravel) will be disposed of at the MBDS.

* Note: for a broader discussion of the Massachusetts Bay Disposal Site (MBDS), refer to the *Massachusetts Bay Disposal Site* megaproject discussion in Chapter IV.

- *Impact on water quality:* extensive dredging may disrupt water quality in the harbor by increasing turbidity in the project area and by triggering the release of contaminants which have accumulated in marine sediments. Proper use of dredging equipment, including sealed dredging buckets, can minimize water quality impairments during the dredging process. However, current water quality modeling has not shown an unacceptable increase in turbidity during dredging and disposal. Monitoring of the project while in progress will be imperative to ensure that minimal water quality violations occur.
- *Impact on marine biota and habitat:* benthic organisms and demersal fish in the project area would be killed during dredging and blasting, although recolonization would be expected approximately one year after construction has ended. If sediments are disposed of at an aquatic site, resident organisms including finfish and marine mammals would be temporarily displaced from the disposal area due to increases in noise and turbidity. Benthic organisms in the disposal area would be buried. Disposal events would be frequent enough to prevent recolonization until the end of the 18-month dredging process.

In-channel disposal with capping reduces the risk of significant environmental harm. Regular monitoring and response by appropriate agencies would reduce this risk further.

- *Source control:* because marine sediments will continue to accumulate in Boston Harbor, periodic maintenance dredging will be necessary to keep navigation channels clear. The proposed Navigation Improvement Project area is expected to generate 1.8 million cubic yards of silt over for the next 50 years. The maintenance dredging of the main ship channel and President Roads anchorage area (not part of the currently proposed Navigation Improvement Project), is expected to generate 4.4 million cubic yards of material over the next 50 years. The quality of these sediments will depend in large measure on pollution loadings to the Boston Harbor during that time. Controlling pollution at the source is the best way to prevent further degradation of the harbor's sediment. An effective source control program will also lower the cost of maintenance dredging in the future.

- *Maintenance Dredging and Disposal:* although source control is extremely important, it is unlikely that the silty sediments which refill Boston's deepened shipping channels will be suitable for open ocean disposal in just ten to fifteen years when the first maintenance dredging will become necessary. Currently, limited viable, environmentally-safe options exist for disposal of this maintenance silt. Alternative technologies for treating contaminated sediments which were not appropriate for the improvement project may be appropriate for maintenance dredging if planning begins now.

Recommended Actions

The Massachusetts Bays Program has attempted to identify areas of environmental concern and build consensus on those actions which should be taken to ensure that the project proceeds in a manner which maximizes benefits for the people of the region and which poses the least risk to the marine ecosystem. The following recommendations have been developed by the staff of the Massachusetts Bays Program, with input from officials from the implementing agencies and interested members of the public.

The Army Corps of Engineers (ACOE) should:

- ensure adequate monitoring of the cap after completion of construction; and
- ensure that appropriate environmental performance standards are incorporated into construction contracts.

Massport, ACOE, EPA, NMFS, and the Massachusetts Executive Office of Environmental Affairs (EOEA) should:

- begin planning now for disposal of contaminated maintenance material, and explore range of applicable alternative technologies; and
- ensure adequate independent monitoring of all dredge and disposal work during construction.

MASSACHUSETTS BAY DISPOSAL SITE (MBDS)*

Background

Current state and federal policies recognize both the need to maintain navigation channels and the need to protect coastal water quality through proper control of dredge and fill operations. It has been estimated that over the next century, more than 23 million cubic yards of sediment will be generated from various dredging projects along the coast of Massachusetts and Cape Cod Bays. The U.S. Environmental Protection Agency (EPA) has determined that available upland disposal sites are not sufficient to meet these disposal needs. Since finding suitable disposal areas is essential to the long-term viability of the nation's ports, EPA and the U.S. Army Corps of Engineers (ACOE) reaffirmed the need to designate an ocean disposal site.

Unlike the other "megaprojects" examined in this chapter of the CCMP, the Massachusetts Bay Disposal Site (MBDS) "project" did not involve any construction. The objective of this purely regulatory project was to identify an ocean disposal site which would minimize potential impacts to the environment. The decision to formally designate the MBDS was important because the site may now be considered as a disposal site for uncontaminated dredged material from other megaprojects examined in this chapter.

Project Description

The Massachusetts Bay Disposal Site (MBDS) is an open water disposal area, roughly 21 nautical miles from Boston and 15 nautical miles from Gloucester. The site is located in waters ranging from 275-300 feet deep, and has a diameter of two nautical miles. Since the 1940s, the area has been used for the disposal of dredged sediments. Federal regulations promulgated in 1977 restricted some ocean dumping practices which were adversely impacting the marine environment, but allowed sediment disposal to continue at more than 100 interim disposal sites, including the MBDS. Between 1982 and 1992, the ACOE disposed or permitted the disposal of approximately 3 million cubic yards of dredged material at the site.

In January 1988, EPA proposed to officially designate a dredged material disposal site in Massachusetts Bay. After investigating several potential sites within an economically and operationally feasible distance from the shore, EPA concluded that the MBDS area best met its established site

selection criteria. However, the EPA decided to relocate the site slightly to the south and west of its former location. The modified site boundary is a circle, two nautical miles in diameter, centered at 70°35.0' west longitude and 42°25.1' north latitude. This location was favored because it:

- preserves the relatively pristine condition of the eastern portion of the former MBDS;
- increases the distance between the disposal site and the National Marine Sanctuary at Stellwagen Bank;
- provides an opportunity to cover previously disposed contaminated sediments; and
- avoids an area of the pre-existing Industrial Waste Site that contains a high concentration of drums.

In August 1993, EPA issued a "Final Rule" which formally designated the MBDS as a disposal site for uncontaminated dredged sediments. Disposal was specifically limited to material which meets the requirements of the Marine Protection, Research, and Sanctuaries Act and its accompanying regulations. These requirements consider impacts to the marine environment, aquatic life, and human health. The Final Rule also prohibited disposal-and-capping of materials too contaminated for unconfined ocean disposal at the MBDS until its efficacy can be effectively demonstrated and it is authorized by law.

EPA's designation of the MBDS was *not* an authorization for the disposal of any particular dredged material at the site. Final site designation simply allows the MBDS to be *considered* as a disposal option when land-based alternatives are not practicable. Since only the actual disposal of dredged material, as authorized by EPA and the ACOE, directly affects Massachusetts Bay, the designation, by itself, will have no impact on the water quality or marine ecology of the Bays.

The Massachusetts Coastal Zone Management Office (CZM) will formally review any activity at the MBDS or modification of site restrictions which may be proposed in the future for consistency with its own policies. Projects also will be reviewed by NOAA, under the Sanctuary Consultation provision of the National Marine Sanctuaries Act (to insure that the activity will not adversely affect the resources or

* Note: for a broader discussion of the dredging issue, refer to the *Dredging and Dredged Materials Disposal* Action Plan in Chapter V.

qualities of the Sanctuary) as well as under Section 7 of the Endangered Species Act (for protected species issues).

Expected Benefits

Designation of the MBDS provides a disposal alternative for uncontaminated dredged material.

Issues of Concern

- *Disposal alternatives for contaminated sediments:* because harbors and ports act as catch basins for industrial pollutants, much of the material dredged in port improvement projects will be contaminated. These contaminated sediments are not suitable for unconfined ocean disposal, and may not be suitable for confinement.

At the present time, there is no disposal site in the Massachusetts Bays region which can accept large volumes of contaminated sediment. Upland disposal sites are prohibitively expensive and have limited capacity. Ocean dumping regulations restrict contaminated sediments from aquatic disposal sites.

The lack of suitable disposal alternatives has been and may continue to be a significant obstacle to all port dredging projects in the Massachusetts Bays region.

If and when the feasibility of capping in deep water has been demonstrated, the MBDS may become a possible disposal site for sediments which are otherwise unsuitable for ocean disposal. However, until the legality and efficacy of this disposal technique has been effectively demonstrated, EPA will not allow contaminated sediments to be disposed at the site. By objecting to ocean disposal of contaminated sediments generated in a number of recent projects, EPA has reaffirmed its commitment to keep contaminated sediments out of the MBDS.

- *Impact on water quality:* the best scientific data available to date indicate that the MBDS is depositional and that past use of the MBDS has not impaired water quality in or around the site. Future disposal of clean material is not expected to degrade water quality significantly, although it will result in unavoidable, localized impacts during and immediately following disposal activities.

- *Impact on marine biota:* possible localized effects associated with use of the MBDS include local mounding of dredged material and the smothering of benthic organisms. However, the ability of these organisms to recolonize in similar sediments probably renders this impact short-term and insignificant. Noticeable effects associated with disposal operations are expected to diminish rapidly as distance from the site increases. EPA does not expect use of the site to have any negative impact on commercial or recreational fishing in the vicinity, and the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) have both concluded that disposal of clean material will not endanger any protected species that may occur in the area, including those which feed in or migrate through the Stellwagen Bank National Marine Sanctuary (SBNMS).

- *Stellwagen Bank National Marine Sanctuary:* the Stellwagen Bank National Marine Sanctuary is located approximately 200 meters from the northeastern perimeter of the MBDS. The regulations of the National Marine Sanctuary prohibit the disposal of dredged material both within the Sanctuary and outside the Sanctuary if the outside-disposed material is likely to enter the Sanctuary and harm a Sanctuary resource or quality. Given the proximity of the Sanctuary to the disposal site, it is therefore critical that barges disposing of dredged material at the MBDS dump the material as close as possible to the permitted disposal location. Recent research conducted by the U.S. Geological Survey and SBNMS has indicated that past disposal activities have been less than precise, and these agencies are working with the U.S. Coast Guard to insure that subsequent disposal operations are monitored more carefully by enforcement personnel.

- *Industrial Waste Site:* for many years, chemicals, low-level radioactive waste, munitions, vessels, and construction debris were disposed at an Industrial Waste Site (IWS) partially overlapping the MBDS.

It is possible that contaminants from the IWS may be degrading water or sediment quality in the MBDS area. Because there are many possible sources of contamination at the MBDS, including the IWS, cause and effect relationships can be difficult to determine. However, in order to develop a sound site management plan, federal agencies will need to distinguish contamination from the IWS and other sources from contamination that may be caused by disposal activities at the MBDS.

During 1991 and 1992, information searches and field surveys were conducted by various federal and state agencies to determine the potential threat posed by past dumping of hazardous materials at the IWS. The EPA is currently synthesizing this information and will prepare an interagency report to provide a comprehensive assessment of the Industrial Waste Site's impact on the marine environment and recommend further action.

- *Site management and monitoring:* all disposal activities at the MBDS must conform with the Ocean Dumping Criteria set forth in 40 CFR Part 227. The ACOE issues permits for individual disposal actions at the MBDS. Site monitoring is the joint responsibility of both EPA and ACOE. These agencies have conducted considerable monitoring at the MBDS over the last two decades, including surveys to determine the composition, distribution, and movement of disposed sediments, food chain interactions in and around the site, and bioaccumulation of contaminants in benthic organisms.

Concern has been expressed about the adequacy of monitoring at the MBDS. The specific components of a long-term monitoring program for the MBDS have not yet been determined. The EPA is currently developing long-term management plans for all of its open water disposal sites, including the MBDS. The MBDS plan, which will include a monitoring component, will be in place by January 1997.

Recommended Actions

The Massachusetts Bays Program has attempted to identify areas of environmental concern and build consensus on those actions which should be taken to ensure that the project proceeds in a manner which maximizes benefits for the people of the region and which poses the least risk to the marine ecosystem. The following recommendations have been developed by the staff of the Massachusetts Bays Program, with input from officials from the implementing agencies and interested members of the public.

EPA, ACOE, and CZM, in consultation with other appropriate federal and state agencies, should:

- lead an interagency study group to define parameters for a demonstration study which could determine whether containment of contaminated sediments (e.g., capping) is a viable disposal option for the MBDS.

EPA and NOAA should:

- complete the interagency comprehensive assessment report on the IWS, giving particular attention to the site's potential impact on water quality and marine habitat in the MBDS area.

SOUTH ESSEX SEWERAGE DISTRICT PROJECT

Background

Salem Sound, in the northern section of Massachusetts Bay, is scheduled to benefit from a project that is in many ways similar to the MWRA's Boston Harbor Project. Like Boston Harbor, Salem Sound has long been used as a receptacle for the residential and industrial wastewater generated in nearby communities. This wastewater is discharged by the South Essex Sewerage District (SESD), a wastewater management authority which serves the nearby communities of Salem, Beverly, Marblehead, Danvers, and Peabody. After passage of the Clean Water Act in 1972, SESD constructed a primary plant to treat the wastewater generated by these communities, while at the same time it applied for a waiver from the requirement that it build secondary treatment facilities. The U.S. Environmental Protection Agency (EPA) initially issued a tentative approval of the waiver, but in its final decision, denied the waiver request. The District appealed EPA's decision throughout the 1980's, until EPA sued to bring the District into compliance.

Project Description

Under the terms of a 1991 court settlement, SESD agreed to build a new secondary treatment plant to meet the water quality criteria of the Clean Water Act. The new plant will be constructed alongside the District's existing primary treatment facilities at Cat Cove, which currently treats about 29 million gallons of wastewater a day. The project will also include some upgrades at the existing primary treatment facilities and a new diffuser system to discharge treated effluent.

Expected Benefits

Water quality improvements should enhance recreational and commercial uses of Salem Sound, as well as improve the health of the marine ecosystem. Existing primary treatment facilities remove approximately 60 percent of the total suspended solids (TSS) and 25-35 percent of the biochemical oxygen demand (BOD). New secondary treatment facilities are expected to remove approximately 90 percent of the TSS and 90 percent of the BOD.

Progress to Date

In January 1994, SESD formally proposed a plan recommending how the cost of the project should be divided among its five constituent communities. Soon after, the District advertised various components of the cleanup project for bidding. Project bids were submitted to the SESD in April 1994. Construction began in July 1994, and is currently slated for completion in 1997.

Issues of Concern

- *Rate increases:* the entire capital plan associated with this project is expected to approach \$260 million. The outside assistance which SESD has received to date includes a \$29 million loan from the federally-assisted state revolving loan program and \$135,000 through a new state grant program initiated expressly to help communities ease high water and sewer rates. However, water and sewer users in the five SESD communities will still bear most of the project's cost. Most ratepayers can reasonably expect their bills to triple over 1990 levels by the time the project is completed. The Commonwealth of Massachusetts, Essex County, and the Town of Middleton--all three of which purchase some services from the SESD--also will pay a small percentage of the overall project cost.
- *Monitoring:* the SESD will need to implement a comprehensive marine monitoring program to determine the effects of secondary effluent in Salem Sound. This program will be most effective if it is integrated with existing monitoring programs, including those efforts currently supported by the Massachusetts Bays Program.

Recommended Actions

The Massachusetts Bays Program has attempted to identify areas of environmental concern and build consensus on those actions which should be taken to ensure that the project proceeds in a manner which maximizes benefits for the people of the region and which poses the least risk to the marine ecosystem. The following recommendations have been developed by the staff of the Massachusetts Bays Program, with input from officials from the implementing agencies and interested members of the public.

All stakeholders in this project, including the South Essex Sewerage District (SESD), the Massachusetts Department of Environmental Protection (DEP), the U.S. Environmental Protection Agency (EPA), and contributing municipalities should:

- promote source reduction as a means of reducing contaminant loadings into Salem Sound;
- promote water conservation; and
- continue to seek state and federal funds to ease rate increases.

SAUGUS RIVER FLOOD CONTROL PROJECT

Background

Coastal estuaries are among the most productive environments on earth, but they are also among the most susceptible to damage from human development. The 1,660-acre Saugus and Pines River Estuary is no exception. This estuary--one of the largest on the northern coast of Massachusetts--contains a rich diversity of habitat, including high and low marsh, pannes, ponds, tidal creeks, and mud flats. Its more than 1,000 acres of vegetated wetland provide habitat for hundreds of species of fish and wildlife. The floodplain in and around this estuary, however, is highly developed. More than 40,000 people live or work there. Residential, industrial and commercial real estate in the floodplain is worth approximately \$3 billion; with building contents and infrastructure included, total property value in the floodplain probably ranges between \$5 to 10 billion.

Like most low-lying estuaries, the Saugus and Pines River Estuary is occasionally inundated by tidal surges during severe storms. In an undeveloped estuary, these tidal flushings are of little concern. In the Saugus and Pines River Estuary, however, coastal flooding can cause extensive property damage. Over the past twenty years, surges associated with six different storms have caused substantial damage to property in the estuary's floodplain. The worst of these storms, the Blizzard of 1978, damaged more than 3,000 homes and businesses and forced the evacuation of some 4,000 people. The U.S. Army Corps of Engineers (ACOE) estimates that today a storm of the same magnitude would cause approximately \$130 million of property damage. The worst storm imaginable (the "Standard Project Northeaster" or SPN) would flood as many as 5,000 buildings and cause an estimated \$500 million in property damage.

Project Description

To protect property in and around the Saugus and Pines River Estuary, the ACOE worked with local governments and the public to develop a project which would reduce coastal storm damage. The proposed Saugus River Floodgate Project would include more than three miles of dikes, walls and sand dunes along the coast. Its principal feature is a series of floodgates across the mouth of the Saugus River--one 100-foot-wide navigation gate and eight 50-foot-wide flushing gates. These floodgates would remain open at most times, but during severe storms they would be closed to prevent tidal surges from spilling into the floodplain. The Commonwealth of Massachusetts would acquire the approximately 1,660 acres of estuarine land, to be used for flood storage and runoff. Future development would be prohibited in this area.

Studies of the \$115 million project were sponsored by the Metropolitan District Commission and the municipalities of Lynn, Malden, Revere, and Saugus. In 1992, the federal government authorized funds to cover 64 percent of the project's cost, leaving the local sponsor to contribute the balance--about \$41 million. Operation and maintenance of the project's structural components and implementation of an estuary management plan would require an additional annual allocation of \$270,000 from the state.

Expected Benefits

The Saugus River Floodgate Project would protect residential, industrial, and commercial property in the 4,000-acre floodplain which overlaps four separate municipalities. Although the project would primarily reduce private property damage within that area, it would also protect important regional utility systems and transportation routes which serve Boston's North Shore, including the Massachusetts Bay Transportation Authority's Blue Line and Routes 1 and 1A. The project would also reduce the costs of emergency evacuation and related services.

Progress to Date

Although the ACOE completed a combined EIS/EIR in 1989, the Saugus River Floodgate Project has not passed beyond the design phase. When asked in 1993 to commit to the project, the Massachusetts Executive Office of Environmental Affairs (EOEA) postponed its decision until further study of other non-structural flood protection measures - supplementing the ACOE's earlier studies - could be accomplished. These would include:

- maintenance and repair of existing dikes, seawalls, and tidal gates;
- retrofitting or elevating the most floodprone structures;
- dike construction;
- wetland acquisition;
- dune restoration;
- a floodplain management plan;
- infrastructure retrofit; and
- an early flood warning system.

Studies to determine the cost-effectiveness of this approach have been completed and reviewed by the ACOE. EOEA is not expected to make a decision on the Saugus River Flood Control Project until it has completed its analysis of the ACOE's technical findings regarding the state's plan and the impacts of current federal budgetary policies.

Issues of Concern

- *Cost effectiveness:* EOEA expected a nonstructural flood protection program to be considerably more cost-effective than the ACOE's proposed action. Although the ACOE's studies indicated that only 7 percent of buildings in the floodplain were candidates for protection under an economically feasible nonstructural program, its analysis looked solely at elevating structures in the 100-year flood plain. The ACOE found EOEA's estimates overly optimistic in light of construction experience.
- *Public safety:* EOEA has acknowledged that a nonstructural approach would not provide the same level of protection as the floodgate project. Since existing storm forecast systems cannot provide much advance warning of flood events in the Saugus and Pines River Estuary, a non-structural flood control strategy would include public infrastructure retrofit, and improved warning and evacuation systems in order to ensure public safety during severe storms.
- *Environmental impact:* the Saugus and Pines River Estuary is by no means pristine. The entire estuary has been steadily degraded by urban pressures, including local storm runoff, oil and gas spills, chemicals, debris, and sewage overflow from flooded systems. An artificial embankment limits tidal flushing in approximately 400 acres of salt marsh. Another 40 acres of drained wetlands have been overtaken by *Phragmites*, a type of reed which has displaced the native flora. Despite these problems, however, the estuary contains significant natural resources. Recognizing the need to protect and maintain these resources, the state designated part of the estuary an "Area of Critical Environmental Concern."

According to the ACOE's assessment, the project would have very little effect on tidal flushing under "gate-open" and present sea level conditions. As a result of engineering modifications intended to maintain near ambient flushing conditions, environmental impacts under the gate-open condition would be minimal. Significant effects are expected to be limited to the direct displacement of about 3 acres of intertidal habitat within the footprint of the structure that would be replaced at the I-95 embankment.

The ACOE has estimated that the floodgates would typically be closed an average of 2-3 times per year for 1-2 hours per closure under existing sea level conditions once the entire tidal wetland has been submerged. Under extreme storm conditions (the 10-year storm or greater), the gates would be closed *before* the entire marsh was flooded in order to provide storage for interior runoff. Because these closures would be so infrequent, they would have a negligible effect on the marsh and estuary. Indeed, the presence of the floodgates would allow for breaching of the abandoned I-95 embankment to restore tidal flushing to the expansive area of salt marsh behind the embankment.

With a one-foot rise in sea level (projected to occur within 100 years at the historic rate of sea level rise), the frequency of floodgate closures is projected to increase to 35-45 per year, with a typical closure duration of 2-3 hours. Such closures would occur during extreme astronomic tides as well as storm conditions. The combined EIR/EIS concluded that changes to the marsh would occur with sea level rise -- as measured against the "without-project" condition -- but was inconclusive with respect to marsh accretion. The ACOE will continue to evaluate the potential ecological effects associated with a rise in sea level and more frequent gate closures if the project as authorized continues to be considered for implementation.

- *Floodplain development:* By lowering construction and insurance costs, the proposed floodgate project might accelerate development in the floodplain. Increased development is undesirable not only because it would put additional pressure on the estuarine ecosystem, but because all property in the floodplain would be highly vulnerable to failure of the system, should such system failure occur.
- *Precedent:* Massachusetts advocates through policy and regulations a nonstructural approach to flood protection. The Saugus River Floodgate Project appears to be inconsistent with the Commonwealth's approach to coastal flooding.

The project would also require variances to several state environmental regulations, such as that which prohibits placing fill in Outstanding Resource Waters. State agencies reviewing these variance requests are expected to be wary of establishing any precedents that weaken the state's environmental regulations. The project has not yet received any of the environmental permits required by the state and cannot proceed to construction until these permits have been granted.

Recommended Actions

The Massachusetts Bays Program supports efforts to develop a flood control plan which takes advantage of recent advances in nonstructural flood mitigation practices and which incorporates the flood protection guidelines of the Department of Environmental Management (DEM). The Massachusetts Bays Program has attempted to identify areas of environmental concern and to build consensus on those actions which should be taken to ensure that the project proceeds in a manner that both maximizes benefits for the people of the region and poses the least risk to the marine ecosystem. If a nonstructural flood protection program is unable to provide adequate defense against storm damage, the Massachusetts Bays Program will support continued work to dovetail the structural expertise of the ACOE with the Commonwealth's policy on flood damage mitigation. While the project is reviewed in greater detail, the following recommendations should be implemented as appropriate.

Coastal communities should:

- strictly enforce municipal ordinances, including zoning ordinances and the Massachusetts Wetlands Protection Act, which regulate development in flood-prone areas.

Coastal communities and DEM should:

- strengthen existing flood protection regulations as appropriate.

EOEA should:

- support efforts to preserve flood storage in the Saugus and Pines River Estuary and investigate a possible alliance with current efforts to restore wetlands;
- discourage development in flood hazard areas and pursue a nonstructural program of flood damage mitigation whenever feasible; and
- provide technical resources and enforcement assistance to communities seeking to tighten enforcement of municipal flood protection ordinances.

PLYMOUTH SEWAGE TREATMENT PROJECT

Background

Centralized treatment facilities are the traditional means of managing wastewater. Unfortunately, as centralized sewer systems age and populations grow, wastewater flows can overwhelm a treatment plant's designed capacity. The disposal of effluent and residuals can then cause a wide array of environmental problems, and can be the source of permitting problems and civil penalties for municipal authorities. To avoid these problems, communities may undertake long-term wastewater facilities planning. In the Massachusetts Bays region, the scientific and regulatory complexities associated with long-term wastewater facilities planning are particularly apparent in the Town of Plymouth. In addition, several other Massachusetts Bays communities (e.g., Gloucester, Barnstable) are undertaking planning efforts similar in scope to Plymouth's. Accordingly, Plymouth is presented here as an example of the complexities of these approaches.

Portions of Plymouth are currently served by a secondary treatment plant which was designed to handle an average flow of 1.75 million gallons per day (mgd). The plant uses an activated sludge process to remove most contaminants from the wastewater, and the treated effluent is discharged into Plymouth Harbor. When the plant became operational in 1970, Plymouth had a population of only 18,600 residents, and average flow was well below the plant's design capacity. However, like many coastal communities, Plymouth experienced explosive growth in the next twenty years. As the town's population expanded, so did the volume of wastewater reaching the treatment plant. Increased flows quickly reduced the plant's efficiency, and by 1977, the Massachusetts Department of Environmental Protection (DEP) began to identify violations of the plant's discharge permit.

Today, more than 47,000 people live in Plymouth. Although the treatment plant still services only a small portion of the town—an area of approximately 2,000 acres in a town with a total of almost 63,000 acres—the strain on the existing facilities has mounted steadily. Daily flows to the plant have at times exceeded 2.3 million gallons. Because the plant was not designed to handle such large flows, its effluent has occasionally exceeded standards set forth in the discharge permit.

In 1987, after ten years of violations, the DEP sued Plymouth to finally force compliance with the permit. In an effort to reduce flows and enhance plant performance, the town completed a major interceptor project in November 1991. Although the interceptor successfully reduced infiltration and inflow, organic loadings to the plant remained relatively constant, and the effluent occasionally violated discharge standards. Three months later, to avoid lengthy court

proceedings and possible civil penalties, Plymouth entered a Consent Decree which established a timetable for initiating and completing additional treatment capacity.

Project Description

Under the terms of the Consent Decree, the Town of Plymouth has been required to conduct a multi-phased Wastewater Treatment Facilities Plan and Environmental Impact Report (FP/EIR) to evaluate feasible management strategies. This report must assess the Town's need for additional treatment capacity and determine the type of facilities that will best meet that need.

Preliminary facilities planning conducted in 1984 had recommended that the Town extend its sewers to portions of West Plymouth and Manomet. West Plymouth includes an industrial park where the Town expects future economic growth. However, the industrial park overlies an aquifer that supplies about 35 percent of the town's public water supply. Because municipal by-laws limit the amount of wastewater that can be discharged in the aquifer's zone of recharge, economic growth could not occur in this area without sewerage. Manomet is a densely populated residential area on the coast. It is characterized by high groundwater and small property lots with outdated, onsite disposal systems (such as cesspools). Although these onsite systems are thought to contribute to water quality problems in public swimming areas, very small lot sizes in a dense portion of Manomet make system upgrades to comply with the basic requirements of Title 5 impossible. West Plymouth's industrial park and the dense central area of Manomet are therefore regarded as priority areas needing better wastewater treatment and disposal solutions.

The new treatment facilities are being designed to handle Plymouth's wastewater through the year 2018. Flows at that time are expected to total 3.0 mgd, although a water conservation program could reduce that amount.

The process of planning facilities to treat this wastewater poses a number of complex technical issues, which must be resolved in an evolving regulatory context. Before any construction can begin, the Town must:

- project its future wastewater flows and decide how far to extend its sewer system;
- decide what type of treatment facilities will most efficiently meet its wastewater needs;
- evaluate potential sites for these facilities;

- decide how to best manage the residuals produced as a by-product of the treatment process; and
- determine how to dispose of the treated effluent.

Overall capital costs for facilities construction will likely range between \$33 million and \$40 million. Operating and maintenance costs will require another \$1.3 to \$1.7 million per year.

Expected Benefits

The benefits of this project cannot be described in detail until a final facilities plan is adopted. However, the planning process now underway is likely to develop a wastewater management plan that serves the long-term interests of the community.

Progress to Date

In April 1992, the Town of Plymouth contracted with the firm of Camp Dresser & McKee to conduct the multi-phased assessment report required by the Consent Decree. *Phase I* of the report, completed in September 1992:

- verified and updated previous wastewater facilities planning;
- screened several feasible treatment and residuals management options;
- defined several facilities alternatives; and
- screened several potential land discharge sites.

Because ocean disposal of the treated effluent would require a variance to the Massachusetts Ocean Sanctuaries Act, Plymouth's consultant recommended that *Phase II* of the Wastewater Treatment Facilities Plan evaluate technologies for wastewater treatment with discharge to land.

The *Phase II* report was completed in October 1993. The best land application alternatives were determined to present unacceptable environmental impacts on surface water and groundwater, including groundwater reserves the Town may need to supplement its municipal water supply. Because the consultant was not able to identify a long-term wastewater management program, Plymouth was granted an extension to the Consent Decree's original schedule to complete a *Phase III* report.

Draft *Phase III* of Plymouth's Wastewater Treatment Facilities Plan was completed in May 1995. This phase of the multi-phased assessment report:

- analyzes wastewater treatment facility needs based on a revised flow of 3.0 mgd (down from the previous 4.2 mgd).
- evaluates all potential feasible land treatment and effluent disposal sites;
- assesses the viability of continued use of the existing wastewater treatment facility on Water Street with its associated 1.75 mgd of harbor outfall capacity;
- evaluates the environmental impacts associated with the various alternatives; and
- recommends a cost-effective and implementable long-term plan to address Plymouth's wastewater needs.

Phase IIIA describes the various components of the recommended plan, discusses financing issues associated with the plan, presents an implementation schedule, and provides a scope of services for *Phase IIIB* that will allow the recommended plan to be finalized.

The goals of the recommended plan are to:

- construct a new 3.0 mgd wastewater treatment facility in order to maximize efficiency of operation;
- relocate the existing treatment facility from the waterfront to a better buffered inland site that has space for future expansion if needed;
- maintain use of the existing harbor outfall to provide multiple methods of effluent disposal; and
- implement a phased approach to use of land-applied effluent so that potential surface water impacts near the land application site can be closely monitored.

Work to be Completed

The *Phase IIIB* scope of work, now underway, will define additional tasks that will be required to finalize the recommended plan. Some currently anticipated tasks include: further field studies of the existing ocean outfall in the harbor, additional environmental impact analyses for the recommended plan sites, and more comprehensive soils and groundwater evaluations. However, the Town also has begun to re-evaluate the amount of industrial and commercial activity to be supported by the wastewater treatment facility, as well as discharge locations relative to Zone II wellhead protection areas and the Eel River.

The Consent Decree originally required facilities to go on-line in 1998. In order to give the consultant sufficient time to complete the Phase III report, that schedule has since been revised. Facilities are not expected to be operational before 2000.

Issues of Concern

- *Extent of sewerage:* at the present time, it is still not clear how far the Town of Plymouth will extend its sewer system, nor how much additional treatment capacity will be needed. The Town's consultant has recommended that, at minimum, the West Plymouth Industrial Park area be sewerage to solve existing or potential water quality and/or health problems. However, the consultant has also recommended that the Town encourage the use of onsite disposal systems whenever possible.

In particular, the recommended plan for Manomet is to rely on on-lot septic system upgrades for most of the Manomet area, and, in the very dense portion, to work with property owners to implement on-site disposal options on adjacent vacant lots that cannot be developed, and to develop shared system solutions where feasible.

- *Effluent disposal:* if no other effluent disposal alternatives are deemed acceptable, Plymouth will likely try to secure a variance to the Ocean Sanctuaries Act which would allow it to extend an outfall beyond the Plymouth-Kingston-Duxbury embayment. Before this variance can be granted, the Town must (1) prove that ocean discharge is the "only feasible alternative" as defined by the law, and (2) demonstrate that the quality of the receiving waters would not violate existing standards established by the Massachusetts DEP.
- *Alternatives to sewerage:* the traditional strategy for managing municipal wastewater is to construct or expand a centralized treatment plant. While there is no doubt that sewerage is better than no action, this response is always expensive, and in the long run, may not adequately address all sources of wastewater contamination. A comprehensive wastewater management plan should carefully examine alternatives to sewerage, such as new decentralized and/or on-site treatment and management technologies and source reduction programs.
- *Septage management:* more than 70 percent of Plymouth's residents currently rely on subsurface systems to dispose of their wastewater. Although the Town has already adopted several local supplements to Title 5, at least half of these on-site systems were installed prior to the promulgation of Title 5, and therefore do not

meet the state's minimum performance or siting standards. On-site sewage systems are currently contributing to water quality problems in Plymouth's groundwater, surface water bodies, and nearshore marine waters.

Even if the proposed sewer expansions are implemented, more than 60 percent of the Town's residents will continue to rely on onsite systems in the year 2018. Therefore, a long-term septage management program is an essential component to Plymouth's wastewater planning.

Recommended Actions

The following recommendations are intended to ensure that the Plymouth Sewerage Project proceeds in a manner which maximizes benefits for the people of the region and which poses the least risk to the marine ecosystem. They have been developed by the staff of the Massachusetts Bays Program, with input from officials from the implementing agencies and the Town of Plymouth, and interested members of the public.

The Town of Plymouth should:

- clearly identify, on a site-specific basis, the specific public health and/or environmental threats caused by on-site wastewater disposal, and direct its consultants to evaluate potential alternatives to central sewerage for each of these areas, including community systems, alternative on-site technologies, system upgrades to Title 5, and inspection and maintenance programs; and
- explore alternatives to sewerage the Industrial Park.

The Massachusetts Department of Environmental Protection (DEP) should:

- encourage Plymouth and other communities, as well as consulting engineering firms, to explore and use alternative and decentralized wastewater treatment and management technologies whenever feasible; and
- aggressively enforce water conservation standards established by the Water Resources Commission (October 1992) to help reduce wastewater flows and the need for additional wastewater treatment and management facilities.

